

(D)

REMARKS

By the Action the Examiner objected to claims 3-5 for an informality. Claims 1-14 were rejected under 35 U.S.C. 112, second paragraph as indefinite. Claims 1 and 15 were rejected under 35 U.S.C. 102(b) as anticipated by Chang (US-4,798,053). Claim 16 was rejected as obvious over Chang in view of Chae (Korean Pub. No. 200248252). The Specification was objected to as failing to provide proper antecedent basis for the claimed subject matter. The drawings were objected to on account of duplicate or inconsistent use of reference numbers. Claims 2-14 were indicated as directed to patentable subject matter.

By the amendment the Specification and claims have been amended to overcome the objections and Section 112 rejections. The rejections based on the prior art are respectfully traversed. Claim 16 has been cancelled. Substitute drawings are submitted. Claims 1-15 remain active.

The amendments to the Specification, while numerous, are for the most part minor, being directed to the correction of reference numerals and providing more consistency in the reference to elements of the disclosure.

The amendments to the claims are also directed to improving clarity of expression and terminological consistency between the claims and the specification to overcome the Section 112, second paragraph rejections. In some cases, particularly claim 9, more in the way of structural relationships between claim elements has been introduced. The Action indicated either a misunderstanding of, or a lack of clarity in, what was intended by the expression "multi-stage compressor" (claim 1) or a "multi-stage air compression system" (claim 15). Claims 1 and 15 have been amended to clarify that this terminology is intended

to refer two stages of air compression with the first being provided by cylinders of an internal combustion engine. The second, higher level of pressure is produced by the second stage, a fluidic amplifier communicating with the engine exhaust plenums. This usage is consistent with the specification as originally submitted. See particularly paragraph [0028]. Several terms objected to by the Examiner, including “pressurized air utilization means”, “means responsive to a negative load”, “means responsive to a non-negative load” and “means responsive to a request for torque” have been replaced.

With the clarification of the term “multi-stage” introduced by the amendments, claims 1 and 15 should be seen to easily distinguish over the Chang ‘053 patent. The Chang ‘053 patent and the Background section to the present application each describe prior art compressed air kinetic energy recovery systems for motor vehicles based on using the engine as a single stage pump to a compressed air tank. Paragraph [0004] of the present specification states that:

the engine itself is a pump, [and] is connected to some of the wheels by the vehicle’s drive line and can be used for compression braking. Unfortunately, even diesel engines, when operated as pumps, operate at too low of a pressure to provide an efficient and compact kinetic energy capture and utilization system.

But this is just such a system as Chang describes. Referring to Fig. 1 of Chang it can be seen that air compressed by the engine during braking is directed into a tank 26 by closing an exhaust valve 22 in the exhaust pipe 18. Chang teaches no second stage of air compression operating off the exhaust manifold or pipes. Hence the Chang system is not show “a multi-stage compressor” as required by claim 1 of the present application or “a multi-stage air compression system” as required by claim 15.

The term “stage” when used in connection with air compression is clearly seen in paragraph [0028] of the present specification to require an increase in air pressure at each stage. Claim 1 as amended has as an element:

a multi-stage compressor including at least a first cylinder of the internal combustion engine for operation as a low pressure compression stage to pump air to the exhaust pipe for the first cylinder and a high pressure stage coupled to the exhaust pipe for the first cylinder for actuation and an outlet from the high pressure stage connected to supply high pressure air to the air storage tank;

Claim 15 requires:

a multi-stage air compression system;

one or more cylinders of the internal combustion engine being available as a low pressure stages in the multi-stage air compression system;

a high pressure stage for the multi-stage compression system actuated by operation of the low pressure stage for pumping air;

The high pressure element of claim 15 was present in the original claim but has been clarified here as to its function.

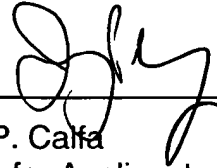
With respect to claim 1 the Examiner identified “an outlet connected to supply high pressure air to the air storage tank” as meeting the multi-stage element requirement. With respect to claim 15 a multi-stage air compression system was found to be met by “an air tank, an air motor and an air motor clutch”. With the clarifying amendments it should be clear that such features do not teach a second high pressure stage in a multiple stage pump wherein the first stage is the engine.

With respect to claim 9 the Examiner objected to a lack of “conditions” expressed in the claim under which the engine operated as a pump. This objection has been met by adding structured relationships between claim elements, namely, by indication of pump operation through an engine controller.

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Applicant believes the Claims as amended are in condition for allowance and respectfully requests favorable action by the Examiner.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'J. Calfa', is written over a horizontal line.

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FIG. 4

FIG. 6